# ABSTRACT

A simulator is disclosed that employs a novel matrix in a domain transform process so as to implement a coherent simulation that accounts for diverse phenomena that are formulated in terms of different sets of variables. The novel matrix also has additional applications that include evaluation of a source term for continuity equations. In one embodiment, the simulator includes a fluid flow simulation block that evaluates phase continuity equations in a first domain and evaluates phase equilibrium and flash equations in a second domain. In performing an inverse transform from second domain components to first domain components, a component distribution matrix is employed so that matrix properties representing an underlying principle of mass conservation are preserved in the inverse transform. Other matrices that relate a component molar density vector to a phase molar density vector are also described.

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